

Development

Volume 113 1991

Editor in Chief

Chris Wylie (Cambridge)

European Editors

Richard Gardner (Oxford)
Walter Gehring (Basel)

Peter Lawrence (Cambridge)
Keith Roberts (Norwich)

USA Editors

Doug Melton (Harvard)
Tom Jessell (Columbia)

Gerry Rubin (Berkeley)

Editorial Advisory Board

Eileen Adamson (La Jolla)
Michael Akam (Cambridge)
Michael Bate (Cambridge)
Rosa Beddington (Edinburgh)
Marianne Bronner-Fraser (Irvine)
Clayton Buck (Wistar Institute)
Alan Colman (Birmingham)
Eric Davidson (Pasadena)
Alun Davies (London)
Françoise Dieterlen (Nogent-sur-Marne)
John Ellis (Warwick)
Gary Felsenfeld (Bethesda)
Richard Firtel (San Diego)
Joseph Frankel (Iowa)
Michael Freeling (Berkeley)
John Gerhart (Berkeley)
Peter Goodfellow (London)
Peter Gruss (Göttingen)
John Gurdon (Cambridge)
John Heath (Oxford)
Brigid Hogan (Vanderbilt)
Nigel Holder (London)
Robert Horvitz (MIT)
Phil Ingham (Oxford)
Herbert Jäckle (Munich)
Rudolph Jaenisch (Whitehead, MIT)
William Jeffery (Austin)
Martin Johnson (Cambridge)
Klaus Kalthoff (Austin)

Robert Kay (Cambridge)
Judith Kimble (Madison)
Charles Kimmel (Eugene)
Klaus Kratochwil (Salzburg)
Ruth Lehmann (Whitehead, MIT)
Julian Lewis (Oxford)
Andrew Lumsden (London)
Mary Lyon (Didcot)
Terry Magnuson (Case Western)
Gail Martin (San Francisco)
Bjorn Olsen (Harvard)
Scott Poethig (Pennsylvania)
Martin Raff (London)
Elizabeth Robertson (Columbia)
Janet Rossant (Toronto)
Joan Ruderman (Harvard)
Matthew Scott (Stanford)
Jonathan Slack (Oxford)
Jim Smith (London)
Michael Sporn (Bethesda)
Claudio Stern (Oxford)
Gary Struhl (Columbia)
Chris Summerville (Michigan)
Azim Surani (Cambridge)
Masatoshi Takeichi (Kyoto)
Peter Thorogood (London)
David Weisblat (Berkeley)
Richard Whittaker (Woods Hole)
Jeff Williams (ICRF, Clare Hall)

Published by The Company of Biologists Limited, Cambridge

The Company of Biologists Limited, founded in 1925, is a 'Company Limited by Guarantee' having tax-exempt charitable status. There is a Board of Directors consisting of about 20 professional biologists, two of them appointed annually by the Society for Experimental Biology, who receive no salary or fees for their services. The Company's main function is to own and produce *The Journal of Experimental Biology*, the *Journal of Cell Science and Development*, and to appoint the Editors of these journals. These are part-time appointments held by established professional biologists of some eminence, and once they have been appointed the Company exercises no control over editorial policy.

The Company is precluded by its charitable status from making a commercial profit on its operations, and its aim is to produce high-quality journals at the lowest possible price. Any surplus on publishing not required for the journals' reserves is transferred to an Educational Trust Fund, which makes substantial grants in aid of societies concerned with the fields of interest covered by the Company's journals. Grants are also made to conferences and summer schools in the fields of its journals.

Erratum

We apologize for the incorrect labelling of Fig. 5 in the article by R. E. Boswell, M. E. Prout and J. C. Steichen entitled 'Mutations in a newly identified *Drosophila melanogaster* gene, *mago nashi*, disrupt germ cell formation and

result in the formation of mirror-image symmetrical double abdomen embryos' *Development* **113**, 373-384 (1991). A correct version of the figure is printed below with its legend.

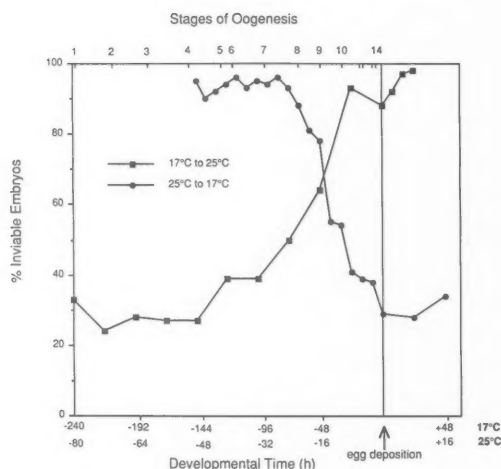


Fig. 5. The temperature-sensitive period for embryonic lethality of *mago*². Each measurement represents the inviability of embryos collected from hemizygous *mago*² mothers, during an 8 h interval (see Experimental Procedures for details). Each time point represents the analysis of the viability of 200 to 1000 embryos. The top abscissa represents the oogenetic stages, as defined by King (King, 1970). The bottom abscissa depicts the developmental times, at 17°C (top) and 25°C (bottom), and the arrow indicates egg deposition. Thus, the negative times represent time during oogenesis prior to oviposition. The 17°C and 25°C time scales have been normalized according to Suzuki (1970) and the oogenetic stages were determined as described by David and Merle (1968).

Typeset, Printed and Published by
The Company of Biologists Limited
Department of Zoology, University of Cambridge, Downing Street,
Cambridge CB2 3EJ

© The Company of Biologists Limited 1991

Contents

Volume 113 1991

ESSAY IN DEVELOPMENT

Davidson, E. H.

Spatial mechanisms of gene regulation in metazoan embryos

1

CONTRIBUTED PAPERS

Rafferty, L. A., Sanicola, M., Blackman, R. K. and Gelbart, W. M.

The relationship of *decapentaplegic* and *engrailed* expression in *Drosophila* imaginal disks: do these genes mark the anterior-posterior compartment boundary?

27

Ray, R. P., Arora, K., Nüsslein-Volhard, C. and Gelbart, W. M.

The control of cell fate along the dorsal-ventral axis of the *Drosophila* embryo

35

Pokrywka, N. J. and Stephenson, E. C.

Microtubules mediate the localization of *bicoid* RNA during *Drosophila* oogenesis

55

Fernandes, J., Bate, M. and VijayRaghavan, K.
Development of the indirect flight muscles of *Drosophila*

67

Bate, M., Rushton, E. and Currie, D. A.

Cells with persistent *twist* expression are the embryonic precursors of adult muscles in *Drosophila*

79

Currie, D. A. and Bate, M.

The development of adult abdominal muscles in *Drosophila*: myoblasts express *twist* and are associated with nerves

91

Broadie, K. S. and Bate, M.

The development of adult muscles in *Drosophila*: ablation of identified muscle precursor cells

103

Howlett, S. K. and Reik, W.

Methylation levels of maternal and paternal genomes during preimplantation development

119

Schlosshauer, B.

Neurothelin: molecular characteristics and developmental regulation in the chick CNS

129

Mortillo, S. and Wassarman, P. M.

Differential binding of gold-labeled zona pellucida glycoproteins mZP2 and mZP3 to mouse sperm membrane compartments

141

Rathjen, F. G., Wolff, J. M. and Chiquet-Ehrismann, R.

Restrictin: a chick neural extracellular matrix protein involved in cell attachment co-purifies with the cell recognition molecule F11

151

Risek, B. and Gilula, N. B.

Spatiotemporal expression of three gap junction gene products involved in fetomaternal communication during rat pregnancy

165

Flanders, K. C., Lüdecke, G., Engels, S., Cissel, D. S., Roberts, A. B., Kondaiah, P., Lafyatis, R., Sporn, M. B. and Unsicker, K.

Localization and actions of transforming growth factor- β s in the embryonic nervous system

183

Bard, J. B. L. and Ross, A. S. A.

LIF, the ES-cell inhibition factor, reversibly blocks nephrogenesis in cultured mouse kidney rudiments

193

Weinmaster, G., Roberts, V. J. and Lemke, G.

A homolog of *Drosophila Notch* expressed during mammalian development

199

Stern, C. D., Artinger, K. B. and Bronner-Fraser, M.

Tissue interactions affecting the migration and differentiation of neural crest cells in the chick embryo

207

Cascio, S. and Zaret, K. S.

Hepatocyte differentiation initiates during endodermal-mesenchymal interactions prior to liver formation

217

Lim, T. M., Jaques, K. F., Stern, C. D. and Keynes, R. J.

An evaluation of myelomeres and segmentation of the chick embryo spinal cord

227

Stern, C. D., Jaques, K. F., Lim, T. M., Fraser, S. E. and Keynes, R. J.

Segmental lineage restrictions in the chick embryo spinal cord depend on the adjacent somites

239

Van Doren, M., Ellis, H. M. and Posakony, J. W.

The *Drosophila extramacrochaetae* protein antagonizes sequence-specific DNA binding by *daughterless/achaete-scute* protein complexes

245

Randazzo, F. M., Cribbs, D. L. and Kaufman, T. C.

Rescue and regulation of *proboscipedia*: a homeotic gene of the Antennapedia Complex

257

Diederich, R. J., Pattatucci, A. M. and Kaufman, T. C.

Developmental and evolutionary implications of *labial*, *Deformed* and *engrailed* expression in the *Drosophila* head

273

Contents

Snape, A. M., Winning, R. S. and Sargent, T. D. Transcription factor AP-2 is tissue-specific in <i>Xenopus</i> and is closely related or identical to Keratin Transcription Factor 1 (KFT-1)	283	Sommer, R. and Tautz, D. Segmentation gene expression in the housefly <i>Musca domestica</i>	419
Fleming, T. P. and Hay, M. J. Tissue-specific control of expression of the tight junction polypeptide ZO-1 in the mouse early embryo	295	Yokouchi, Y., Ohsugi, K., Sasaki, H. and Kuroiwa, A. Chicken homeobox gene <i>Msx-1</i> : structure, expression in limb buds and effect of retinoic acid	431
Harris, A., Chalkley, G., Goodman, S. and Coleman, L. Expression of the cystic fibrosis gene in human development	305	Martín-Bermudo, M. D., Martínez, C., Rodríguez, A. and Jiménez, F. Distribution and function of the <i>lethal of scute</i> gene product during early neurogenesis in <i>Drosophila</i>	445
Patek, C. E., Kerr, J. B., Gosden, R. G., Jones, K. W., Hardy, K., Muggleton-Harris, A. L., Handyside, A. H., Whittingham, D. G. and Hooper, M. L. Sex chimaerism, fertility and sex determination in the mouse	311	von Bartheld, C. S., Patterson, S. L., Heuer, J. G., Wheeler, E. F., Bothwell, M. and Rubel, E. W. Expression of nerve growth factor (NGF) receptors in the developing inner ear of chick and rat	455
Muschler, J. L. and Horwitz, A. F. Down-regulation of the chicken $\alpha_5\beta_1$ integrin fibronectin receptor during development	327	Bejsovec, A. and Martinez Arias, A. Roles of <i>wingless</i> in patterning the larval epidermis of <i>Drosophila</i>	471
Sutherland, A. E., Sanderson, R. D., Mayes, M., Seibert, M., Calarco, P. G., Bernfield, M. and Damsky, C. H. Expression of syndecan, a putative low affinity fibroblast growth factor receptor, in the early mouse embryo	339	Shiurba, R. A., Jing, N., Sakakura, T. and Godsave, S. F. Nuclear translocation of fibroblast growth factor during <i>Xenopus</i> mesoderm induction	487
Miller, R. H. and Szigeti, V. Clonal analysis of astrocyte diversity in neonatal rat spinal cord cultures	353	Render, J. Fate maps of the first quartet micromeres in the gastropod <i>Ilyanassa obsoleta</i>	495
Hogan, A., Heyner, S., Charron, M. J., Copeland, N. G., Gilbert, D. J., Jenkins, N. A., Thorens, B. and Schultz, G. A. Glucose transporter gene expression in early mouse embryos	363	Fire, A., Albertson, D., Harrison, S. W. and Moerman, D. G. Production of antisense RNA leads to effective and specific inhibition of gene expression in <i>C. elegans</i> muscle	503
Boswell, R. E., Prout, M. E. and Steichen, J. C. Mutations in a newly identified <i>Drosophila melanogaster</i> gene, <i>mago nashi</i> , disrupt germ cell formation and result in the formation of mirror-image symmetrical double abdomen embryos	373	Baird, S. E., Fitch, D. H. A., Kassem, I. A. A. and Emmons, S. W. Pattern formation in the nematode epidermis: determination of the arrangement of peripheral sense organs in the <i>C. elegans</i> male tail	515
Livant, D. L., Hough-Evans, B. R., Moore, J. G., Britten, R. J. and Davidson, E. H. Differential stability of expression of similarly specified endogenous and exogenous genes in the sea urchin embryo	385	Wolfgang, W. J., Quan, F., Thambi, N. and Forte, M. Restricted spatial and temporal expression of G-protein α subunits during <i>Drosophila</i> embryogenesis	527
Hope, I. A. 'Promoter trapping' in <i>Caenorhabditis elegans</i>	399	Matsuo, I., Kitamura, M., Okazaki, K. and Yasuda, K. Binding of a factor to an enhancer element responsible for the tissue-specific expression of the chicken α A-crystallin gene	539
Johnston, A. R. and Gooday, D. J. <i>Xenopus</i> temporal retinal neurites collapse on contact with glial cells from caudal tectum <i>in vitro</i>	409	Nasr-Esfahani, M. M. and Johnson, M. H. The origin of reactive oxygen species in mouse embryos cultured <i>in vitro</i>	551

Latham, K. E. and Solter, D. Effect of egg composition on the developmental capacity of androgenetic mouse embryos	561	Yoshinaga, K., Nishikawa, S., Ogawa, M., Hayashi, S.-I., Kunisada, T., Fujimoto, T. and Nishikawa, S.-I. Role of <i>c-kit</i> in mouse spermatogenesis: identification of spermatogonia as a specific site of <i>c-kit</i> expression and function	689
Miller, M., Reddy, B. A., Kloc, M., Li, X. X., Dreyer, C. and Etkin, L. D. The nuclear-cytoplasmic distribution of the <i>Xenopus</i> nuclear factor, <i>xnf7</i> , coincides with its state of phosphorylation during early development	569	Sink, H. and Whittington, P. M. Early ablation of target muscles modulates the arborisation pattern of an identified embryonic <i>Drosophila</i> motor axon	701
Pittack, C., Jones, M. and Reh, T. A. Basic fibroblast growth factor induces retinal pigment epithelium to generate neural retina <i>in vitro</i>	577	Palmer, S. J. and Burgoyne, P. S. The <i>Mus musculus domesticus</i> <i>Tdy</i> allele acts later than the <i>Mus musculus musculus</i> <i>Tdy</i> allele: a basis for XY sex-reversal in C57BL/6-Y ^{POS} mice	709
Blumenfeld, M., Maury, M., Chouard, T., Yaniv, M. and Condamine, H. Hepatic Nuclear Factor 1 (HNF1) shows a wider distribution than products of its known target genes in developing mouse	589	Torres, M. and Sánchez, L. The sisterless-b function of the <i>Drosophila</i> gene <i>scute</i> is restricted to the stage when the X:A ratio determines the activity of <i>Sex-lethal</i>	715
MacKenzie, A., Ferguson, M. W. J. and Sharpe, P. T. <i>Hox-7</i> expression during murine craniofacial development	601	Mendelsohn, C., Ruberte, E., LeMeur, M., Morriss-Kay, G. and Chambon, P. Developmental analysis of the retinoic acid-inducible RAR- β 2 promoter in transgenic animals	723
Münsterberg, A. and Lovell-Badge, R. Expression of the mouse anti-Müllerian hormone gene suggests a role in both male and female sexual differentiation	613	Jack, J., Dorsett, D., Delotto, Y. and Liu, S. Expression of the <i>cut</i> locus in the <i>Drosophila</i> wing margin is required for cell type specification and is regulated by a distant enhancer	735
Bovolenta, P. and Dodd, J. Perturbation of neuronal differentiation and axon guidance in the spinal cord of mouse embryos lacking a floor plate: analysis of Danforth's short-tail mutation	625	Holmgren, L., Glaser, A., Pfeifer-Ohlsson, S. and Ohlsson, R. Angiogenesis during human extraembryonic development involves the spatiotemporal control of PDGF ligand and receptor gene expression	749
Stark, K. L., McMahon, J. A. and McMahon, A. P. FGFR-4, a new member of the fibroblast growth factor receptor family, expressed in the definitive endoderm and skeletal muscle lineages of the mouse	641	Fishell, G. and Hatten, M. E. Astrotactin provides a receptor system for CNS neuronal migration	755
Huszar, D., Sharpe, A., Hashmi, S., Bouchard, B., Houghton, A. and Jaenisch, R. Generation of pigmented stripes in albino mice by retroviral marking of neural crest melanoblasts	653	Coutifaris, C., Kao, L.-C., Sehdev, H. M., Chin, U., Babalola, G. O., Blaschuk, O. W. and Strauss III, J. F. E-cadherin expression during the differentiation of human trophoblasts	767
Slack, J. M. W. The nature of the mesoderm-inducing signal in <i>Xenopus</i> : a transfilter induction study	661	Escalier, D., Gallo, J.-M., Albert, M., Meduri, G., Bermudez, D., David, G. and Schrevel, J. Human acrosome biogenesis: immunodetection of proacrosin in primary spermatocytes and of its partitioning pattern during meiosis	779
Brook, F. A., Shum, A. S. W., van Straaten, H. W. M. and Copp, A. J. Curvature of the caudal region is responsible for failure of neural tube closure in the curly tail (<i>ct</i>) mouse embryo	671	Choi, T., Aoki, F., Mori, M., Yamashita, M., Nagahama, Y. and Kohmoto, K. Activation of p34 ^{cdc2} protein kinase activity in meiotic and mitotic cell cycles in mouse oocytes and embryos	789
Barton, S. C., Ferguson-Smith, A. C., Fundele, R. and Surani, M. A. Influence of paternally imprinted genes on development	679		

Contents

Stern, M. J. and Horvitz, H. R. A normally attractive cell interaction is repulsive in two <i>C. elegans</i> mesodermal cell migration mutants	797	Goodbody, K. C., Venverloo, C. J. and Lloyd, C. W. Laser microsurgery demonstrates that cytoplasmic strands anchoring the nucleus across the vacuole of premitotic plant cells are under tension. Implications for division plane alignment	931
Wedeen, C. J. and Weisblat, D. A. Segmental expression of an <i>engrailed</i> -class gene during early development and neurogenesis in an annelid	805	Fundele, R., Howlett, S. K., Kothary, R., Norris, M. L., Mills, W. E. and Surani, M. A. Developmental potential of parthenogenetic cells: role of genotype-specific modifiers	941
Rogers, M. B., Hosler, B. A. and Gudas, L. J. Specific expression of a retinoic acid-regulated, zinc-finger gene, Rex-1, in preimplantation embryos, trophoblast and spermatocytes	815	Haberstroh, L., Galindo, J. and Firtel, R. A. Developmental and spatial regulation of a <i>Dictyostelium</i> prespore gene: <i>cis</i> -acting elements and a cAMP-induced, developmentally regulated DNA-binding activity	947
Wolff, T. and Ready, D. F. Cell death in normal and rough eye mutants of <i>Drosophila</i>	825	Inuzuka, H., Redies, C. and Takeichi, M. Differential expression of R- and N-cadherin in neural and mesodermal tissues during early chicken development	959
Wolf, T. and Ready, D. F. The beginning of pattern formation in the <i>Drosophila</i> compound eye: the morphogenetic furrow and the second mitotic wave	841	Perris, R., Krotoski, D. and Bronner-Fraser, M. Collagens in avian neural crest development: distribution <i>in vivo</i> and migration-promoting ability <i>in vitro</i>	969
Abdallah, B., Hourdry, J., Deschamps, S., Denis, H. and Mazabraud, A. The genes encoding the major 42S storage particle proteins are expressed in male and female germ cells of <i>Xenopus laevis</i>	851	Vaahokari, A., Vainio, S. and Thesleff, I. Associations between transforming growth factor β 1 RNA expression and epithelial-mesenchymal interactions during tooth morphogenesis	985
Schmid, P., Lorenz, A., Hameister, H. and Montenarh, M. Expression of p53 during mouse embryogenesis	857	Kawamura, K., Fujiwara, S. and Sugino, Y. M. Budding-specific lectin induced in epithelial cells is an extracellular matrix component for stem cell aggregation in tunicates	995
Robinson, S. D., Silberstein, G. B., Roberts, A. B., Flanders, K. C. and Daniel, C. W. Regulated expression and growth inhibitory effects of transforming growth factor- β isoforms in mouse mammary gland development	867	Hirano, S., Ui, K., Miyake, T., Uemura, T. and Takeichi, M. <i>Drosophila</i> PS integrins recognize vertebrate vitronectin and function as a cell-substrate adhesion receptors <i>in vitro</i>	1007
Gailey, D. A., Taylor, B. J. and Hall, J. C. Elements of the <i>fruitless</i> locus regulate development of the muscle of Lawrence, a male-specific structure in the abdomen of <i>Drosophila melanogaster</i> adults	879	Lyons, G. E., Muhlebach, S., Moser, A., Masood, R., Paterson, B. M., Buckingham, M. E. and Perriard, J.-C. Developmental regulation of creatine kinase gene expression by myogenic factors in embryonic mouse and chick skeletal muscle	1017
Lawson, K. A., Meneses, J. J. and Pedersen, R. A. Clonal analysis of epiblast fate during germ layer formation in the mouse embryo	891	Tajima, Y., Onoue, H., Kitamura, Y. and Nishimune, Y. Biologically active kit ligand growth factor is produced by mouse Sertoli cells and is defective in <i>Sl^d</i> mutant mice	1031
Herrmann, B. G. Expression pattern of the <i>Brachyury</i> gene in whole-mount T^{Wis}/T^{Wis} mutant embryos	913	Gardner, C. A. and Barald, K. F. The cellular environment controls the expression of <i>engrailed</i> -like protein in the cranial neuroepithelium of quail-chick chimeric embryos	1037
Dardik, A. and Schultz, R. M. Blastocoel expansion in the preimplantation mouse embryo: stimulatory effect of TGF- α and EGF	919		

Moase, C. E. and Trasler, D. G. N-CAM alterations in splotch neural tube defect mouse embryos	1049	Sanes, J. R., Johnson, Y. R., Kotzbauer, P. T., Mudd, J., Hanley, T., Martinou, J.-C. and Merlie, J. P. Selective expression of an acetylcholine receptor-lacZ transgene in synaptic nuclei of adult muscle fibres	1181
Nghiêm, H.-O., Hill, J. and Changeux, J.-P. Developmental changes in the subcellular distribution of the 43K (v_1) polypeptides in <i>Torpedo marmorata</i> electrocyte: support for a role in acetylcholine receptor stabilization	1059	Krauss, S., Johansen, T., Korzh, V. and Fjose, A. Expression of the zebrafish paired box gene <i>pax[<i>zf-b</i>]</i> during early neurogenesis	1193
Lallier, T. and Bronner-Fraser, M. Avian neural crest cell attachment to laminin: involvement of divalent cation dependent and independent integrins	1069	Motro, B., van der Kooy, D., Rossant, J., Reith, A. and Bernstein, A. Contiguous patterns of <i>c-kit</i> and <i>steel</i> expression: analysis of mutations at the <i>W</i> and <i>Sl</i> loci	1207
Cameron, R. A., Fraser, S. E., Britten, R. J. and Davidson, E. H. Macromere cell fates during sea urchin development	1085	Duffy, J. B., Kania, M. A. and Gergen, J. P. Expression and function of the <i>Drosophila</i> gene <i>runt</i> in early stages of neural development	1223
Lazzaro, D., Price, M., de Felice, M. and Di Lauro, R. The transcription factor TTF-1 is expressed at the onset of thyroid and lung morphogenesis and in restricted regions of the foetal brain	1093	Weliky, M., Minsuk, S., Keller, R. and Oster, G. Notochord morphogenesis in <i>Xenopus laevis</i> : simulation of cell behaviour underlying tissue convergence and extension	1231
Poirier, F., Chan, C.-T. J., Timmons, P. M., Robertson, E. J., Evans, M. J. and Rigby, P. W. J. The murine <i>H19</i> gene is activated during embryonic stem cell differentiation <i>in vitro</i> and at the time of implantation in the developing embryo	1105	Brown, N. L., Sattler, C. A., Markey, D. R. and Carroll, S. B. <i>hairy</i> gene function in the <i>Drosophila</i> eye: normal expression is dispensable but ectopic expression alters cell fates	1245
Copenhaver, P. F. and Taghert, P. H. Origins of the insect enteric nervous system: differentiation of the enteric ganglia from a neurogenic epithelium	1115	Herrera, P.-L., Huarte, J., Sanvito, F., Meda, P., Orci, L. and Vassalli, J.-D. Embryogenesis of the murine endocrine pancreas; early expression of pancreatic polypeptide gene	1257
Itasaki, N., Ichijo, H., Hama, C., Matsuno, T. and Nakamura, H. Establishment of rostrocaudal polarity in tectal primordium: <i>engrailed</i> expression and subsequent tectal polarity	1133	Chouinard, S. and Kaufman, T. C. Control of expression of the homeotic <i>labial</i> (<i>lab</i>) locus of <i>Drosophila melanogaster</i> : evidence for both positive and negative autogenous regulation	1267
Papalopulu, N., Clarke, J. D. W., Bradley, L., Wilkinson, D., Krumlauf, R. and Holder, N. Retinoic acid causes abnormal development and segmental patterning of the anterior hindbrain in <i>Xenopus</i> embryos	1145	Lumsden, A., Sprawson, N. and Graham, A. Segmental origin and migration of neural crest cells in the hindbrain region of the chick embryo	1281
Holder, N. and Hill, J. Retinoic acid modifies development of the midbrain-hindbrain border and affects cranial ganglion formation in zebrafish embryos	1159	Yoshika, A., Hanazono, M., Oda, S.-I., Wakasugi, N., Sakakura, T. and Kusakabe, M. Developmental analysis of the eye lens obsolescence (<i>Elo</i>) gene in the mouse: cell proliferation and <i>Elo</i> gene in the aggregation chimera	1293
Zhang, C.-C., Müller, J., Hoch, M., Jäckle, H. and Bienz, M. Target sequences for <i>hunchback</i> in a control region conferring <i>Ultrabithorax</i> expression boundaries	1171	Schiavone, F. M. and Racusen, R. H. Regeneration of the root pole in surgically transected carrot embryos occurs by position-dependent, proximodistal replacement of missing tissues	1305

Contents

Liu, C.-P. and Auerbach, R. <i>In vitro</i> development of murine T cells from prethymic and preliver embryonic yolk sac hematopoietic stem cells	1315	Osmond, M. K., Butler, A. J., Voon, F. C. T. and Bellairs, R. The effects of retinoic acid on heart formation in the early chick embryo	1405
Mann, J. R. and Stewart, C. L. Development to term of mouse androgenetic aggregation chimeras	1325	Orr-Urtreger, A., Givol, D., Yayon, A., Yarden, Y. and Lonai, P. Developmental expression of two murine fibroblast growth factor receptors, <i>flg</i> and <i>bek</i>	1419
Levi, G., Ginsberg, D., Girault, J.-M., Sabanay, I., Thiery, J. P. and Geiger, B. EP-cadherin in muscles and epithelia of <i>Xenopus laevis</i> embryos	1335	Walther, C. and Gruss, P. <i>Pax-6</i> , a murine paired box gene, is expressed in the developing CNS	1435
Xiang, M., Lu, S.-Y., Musso, M., Karsenty, G. and Klein, W. H. A G-string positive <i>cis</i> -regulatory element in the LpS1 promoter binds two distinct nuclear factors distributed non-uniformly in <i>Lytechinus pictus</i> embryos	1345	Godin, I. and Wylie, C. C. TGF β 1 inhibits proliferation and has a chemotrophic effect on mouse primordial germ cells in culture	1451
Carmena, M., Gonzalez, C., Casal, J. and Ripoll, P. Dosage dependence of maternal contribution to somatic cell division in <i>Drosophila melanogaster</i>	1357	González-Reyes, A. and Morata, G. Organization of the <i>Drosophila</i> head as revealed by the ectopic expression of the Ultrabithorax product	1459
French-Constant, C., Hollingsworth, A., Heasman, J. and Wylie, C. C. Response to fibronectin of mouse primordial germ cells before, during and after migration	1365	Snow, D. M., Watanabe, M., Letourneau, P. C. and Silver, J. A chondroitin sulfate proteoglycan may influence the direction of retinal ganglion cell outgrowth	1473
Yuen, I. S., Taphouse, C., Halfant, K. A. and Gomer, R. H. Regulation and processing of a secreted protein that mediates sensing of cell density in <i>Dictyostelium</i>	1375	Coelho, C. N. D., Krabbenhoft, K. M., Upholt, W. B., Fallon, J. F. and Kosher, R. A. Altered expression of the chicken homeobox- containing genes GHox-7 and GHox-8 in the limb buds of <i>limbless</i> mutant chick embryos	1487
Frank, D. and Harland, R. M. Transient expression of XMyoD in non-somitic mesoderm of <i>Xenopus</i> gastrulae	1387	Kintner, C. R. and Dodd, J. Hensen's node induces neural tissue in <i>Xenopus</i> ectoderm. Implications for the action of the organizer in neural induction	1495
Goriely, A., Dumont, N., Dambly-Chaudière, C. and Ghysen, A. The determination of sense organs in <i>Drosophila</i> : effect of the neurogenic mutations in the embryo	1395	1991 Index of Authors and Titles	1507
		1991 Subject Index	1523

